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ABSTRACT

This report describes a curriculum development project aimed at improving the teaching of neurology to undergraduate medical students; and providing more effective instruction in neurology for the practicing physician. The project involved: (1) development of a balanced presentation of neurological teaching from undergraduate medical education through postgraduate years; (2) introduction and further expansion of the use of a professional medical model in neurological teaching, including the further development and use of the evaluative technique known as the "programmed patient"; (3) production and use of short self instructional films demonstrating neurological skills; and (4) introduction of regular faculty workshops in neurological teaching. The report alsc deals with the problems of motivation, informational resources, core curriculum, educational goals and evaluative techniques. It describes experimental approaches used in neurological teaching in the areas of goals, evaluation techniques related to clinical goals, and teaching methods developed to solve some of the problems met in local neurological educational programs. Ten appendices, including some related articles, are attached. (AF)

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FINAL REPORT

Cooperative Research Project No. H-298, Contract OE 6-10-121

August 1, 1965 - December 31, 1968

UNDERGRADUATE AND POSTGRADUATE TEACHING OF NEUROLOGY

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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FOREWORD

The report which follows describes the activities conducted under contract number OE-6-10-121. The general objectives of that project, a curriculum improvement project, were twofold: (a) to improve the teaching of neurology to undergraduate medical students and (b) to provide more effective instruction in neurology for the practicing physician. The procedures in this project involved the entire faculty of the Department of Neurology as well as representatives of the Departments of Anatomy, Physiology, Radiology, and Pathology.

Four major areas of curriculum improvement were involved: (a) development of a balanced presentation of neurological teaching from undergraduate medical education up through postgraduate years; (b) introduction and further expansion of the use of a professional medical model in neurological teaching including the further development and use of the evaluative technique referred to as "the programmed patient;" (c) production and use of short instructional films for demonstrating neurological skills on a self-study basis; and (d) introduction of regular faculty workshops in neurological teaching.

In each of these major areas, the project has been successful in achieving its aims.

a. There has been a complete revision of the curriculum in neurological teaching from undergraduate medical education up through postgraduate years. This has been achieved through careful study of curriculum by the faculty of the Department of Neurology--and has been successfully integrated with the development of a total new curriculum for undergraduate medical students.

b. The use of a professional medical model in neurological teaching has significantly and substantially increased and improved. There are many different applications of this technique, both within the

Department of Neurology and elsewhere in the School of Medicine. In addition, other medical schools have attempted to apply this technique to their own teaching problems. As many as seven different models are available for instructional purposes at the present time.

c. Thirty-four self-instructional films have been completed and another 36 are in various stages of completion. These single-concept films are available in technicolor cartridges and have indeed been used by other medical schools. During the course of this project, the use of these films was tested with third-year medical students.

d. Regular faculty workshops in neurological teaching were held for members of the Department of Neurology along with representatives of other departments in the School of Medicine. Through these workshops, educational objectives were defined and modified and the ultimate development of total curriculum was facilitated.

All of these aspects of the project are described in the report which follows. Copies of the films have already been forwarded to the U.S. Office of Education. Reprints of articles, likewise, have been mailed in as they were published. The "Technical Progress Reports" were, for the most part, in some detail and included a more comprehensive presentation of these various parts.

INTRODUCTION

The need for more effective neurology teaching programs has become a topic of concern best reflected by the National Conference on Education in the Neurological Sciences, sponsored by the combined American Academy of Neurology, American Neurological Association and the National Institute for Neurological Diseases and Blindness in 1966 and by the recent literature on neurological education. (14,15,17) The reasons for this concern are multiple. There is a large amount of neurological disease in this country, associated with disability and economic loss that is disproportionate to the small numbers of neurologists in practice. (10,17) This problem is intensified by the fact that more than fifty of the country's schools of medicine do not have a department of neurology, crucial for the recruitment of men into the field. (12) A significant number of patients in all medical disciplines have manifestations of neurological disease, either as a primary neurological disease or as a manifestation of systemic disease; estimated variously at 20 to 30 percent. (1,17) This implies increasing need to train primary physicians, internists and other specialists who may be dealing with neurological disease in neurology. In addition, the proliferation of basic science information in the neurosciences over the past two decades has led to an increasing amount of information that must be assimilated by the man training in the neurosciences. Information that is necessary to perform further investigative research or for improvement in the clinical care of patients with neurological disease. The challenge of neurological education

in this area is intensified by the fact that the amount of time a medical curriculum can devote to any particular discipline, as neurology, seems to be shrinking with the proliferation of information in other fields and the creation of new disciplines within medicine that compete for time with the student. The amount of time devoted to neurological teaching seems to vary widely throughout those schools that do have departments of neurology. (14,15)

The effects of these pressures for increased training in neurosciences has lead to concern for better methods, approaches, techniques and experiences to offer the student, resident and postgraduate physician. The response to these pressures can express itself as a tendency for those who have teaching responsibility in neurology to develop programs with more personnel, an attractive array of audio-visual gadgetry, more extensive informational resources and the addition of more esoteric experiences and activities. There is no clear-cut evidence that this type of response, which is expensive and time consuming, will increase the effectiveness of learning. (13) As with medical education as a whole, we are considerably hampered in our design of neurological teaching programs by the lack of well-designed experiments in learning and by methods to evaluate the effectiveness of learning. The choice of techniques and teaching design is usually based on fad, personal interest, or faith that on the face of it, such techniques should "obviously improve learning." A neurologist would not diagnose, treat a patient or perform research without a working knowledge of the body of science basic to his activity. Nor would he pro-

ceed in these endeavors without rather clear-cut objectives and repeated evaluation of progress. Now that education has become such a pressing need for the field of neurology it is important that the neurologist with teaching responsibility becomes familiar with educational principles. It is also important that he incorporate educational objectives or hypotheses in his activities and utilizes appropriate evaluation techniques. At the National Conference on Education in the Neurological Sciences, Sanazaro said "what is required is the simple and direct application of educational engineering to the planning, design, conduct, and evaluation of the instructional program." (16) The opinion has been expressed that teaching has been sacrificed for research productivity in neurological programs. (1, 15) Careful research in neurological education, as a science, is sorely needed to develop more effective and efficient teaching. This is a field not foreign to the work and interest of many neurologists in behavior and learning.

This report describes some of the problems that seem to exist in neurological education, undergraduate and postgraduate. The report also describes some experimental approaches to education in an area where the need for neurological training is great.

BACKGROUND

The pressures and needs associated with developing an integrated neurological teaching program in the predoctoral years of the University of Southern California School of Medicine and in the postdoctoral years of a three-year neurological residency program at the Los Angeles County/

University of Southern California Medical Center with a very small faculty and large administrative and service responsibility encouraged interest and activity in the field of medical education. The problems and projects described here are a product of this activity. This report draws freely on experiences provided by the contract through working with the Department of Research in Medical Education, under Dr. Stephen Abrahamson, working with the Medical Education and Curriculum Committee of the University of Southern California School of Medicine as it embarked upon a major revision of the curriculum, in faculty workshops on neurological education and in conferences in this country and others concerning medical education.

PROBLEMIC ASPECTS OF NEUROLOGICAL EDUCATION

EDUCATIONAL RESOURCES

The ever increasing array of audio-visual gadgetry and equipment is a tribute to creativity and technicological resources in the hardware of the education industry. We can project transparent and opaque, overhead, from in front and behind. We can write and draw on transparent projections and they can wiggle with a life of their own showing flow and motion. We can produce slides of all varieties, in minutes, and everyone seems to have a camera or photographer available. Film comes in strips, loops and reels, in 8 mm., Super 8 mm. and 16 mm. These can be in sound or programmed with tapes or combined with other varieties of display. Television appears in every corner of present day academic centers. Miles of television tape is accumulating, produced by cameras that are manned, remote

and portable. Audio-tape is multi-channeled and provides signals in addition to its audio content that will program slides, film, television, etc. etc. into an audio-visual smorgasbord that can submerge the cortex of the listener with cascading symbols of sight and sound. The humble printed or typed word, sketches, photographs and diagrams can be reproduced by the thousands in moments by a great variety of reproducing machines. Student files are burgeoning with handouts, protocols, outlines and syllabi in all subjects. The problem with these resources resides in their use.

This embarrassment of audio-visual riches has caused many faculty members to feel that they must keep up with the trend and use audio-visual aids to "improve" their teaching. An expensive outlay such as with television for example, is then used, or film loops, or hundreds of slides, etc., without regard for the appropriateness of the medium chosen. Various media vary widely in their expense. The personnel needed for maintenance and operation, professional training needed to prepare material for a specific medium reproduceability, accuracy, transportability, etc. vary with each. Each has a certain specific appropriateness for a variety of information to be transferred to the learner. For example, it is impractical to use film or television for presentation of diagrams or textual material; a reprint would be far cheaper and could be studied more conveniently and for a longer time. A prepared case presentation can often be more cheaply put on film than television. Film is much easier to store, transport and keep over a long period of time. Television is more appropriate where immediacy and listener feedback is important.

Film is more accurate in detail and can be edited more creatively and readily than television tape. The erasability of television tape as opposed to film offers it an advantage in documenting events in which the educational value cannot be determined until the "happening" is over. Other considerations of cost, software needed, personnel etc. can be a surprise when considered. The more fundamental questions of the value of color versus its expense, the effectiveness of music, the best format for diagrams or words, the degree to which the listener or student should contribute to the medium has yet to be determined. From the standpoint of teaching effectiveness and budget, it is important that all neurological faculty are aware of the "pros" and "cons" of every medium and be as at home with these twentieth century tools as he is with the nineteenth century media of blackboard and slides.

The second problem with informational resources is well characterized by Miller " - the education technology industry knows a great deal about the science and technology of information processing and transmission, but it knows very little about the human receiver". (13) There is no real evidence that the use of these media increases the amount of information retained or comprehended by the student and even more importantly, as will be developed later, there is certainly no information that they improve the behavior or performance of the student compared to more conventional teaching methods.

Therefore, for many reasons we cannot just assume that if it is audio-visual it must be good. Various media must not be used on the

basis of teacher whim but only if they solve a particular educational need. There is no question that closed circuit television presents material into the classroom or seminar of immediate educational value that would have been otherwise impossible. Television and film can describe spatial temporal factors and the related actions of simultaneous activities. This is particularly important to neurology in showing locomotion, movement, performance skills and to gain a better understanding of the relations of simultaneous physiological events as, for example, the nerve impulse - certainly far more effective than printed texts or diagrams traditionally used to describe these activities. There seems little doubt that visual textbooks that can be used for ready reference must more and more become a standard item for self study alongside of the printed book.

Self study, also a media problem, is developing into ever increasing importance as emphasis is shifting to the student to develop responsibility for his own learning, at his own pace, in his own manner. Visual self study aides allow the teacher to demonstrate experiments, patients, "how to" skills in a self study aid that allows the student to see this material whenever he needs it: morning, noon, night, or on weekends, independent of faculty schedules. This is a partial solution to the ever decreasing exposure time to the student. It is also a solution to many of the repetitious needs for teaching of many basic concepts as the nerve impulse, the neurological examination, laboratory skills, lumbar puncture, signs and symptoms of disease, etc.

CORE CONTENT (CORE CURRICULA)

With the phenomenal informational increase present in all fields of medicine, each department has insisted on more time to impart more information and skills. This has quite naturally led to need, especially by curriculum planners, to identify what is truly the "essential" information from each discipline that must be imparted to the medical student. One problem is that the term "core content" implies that the medical school is going to turn out only one model of physician and there is no recognition of the multitudinous backgrounds of entering students and their different career goals. The student inclined for neurology is naturally felt to need an offering of more neurological riches to both motivate and prepare him for the field of neurology. However, this is questionable. It might be more appropriate that the student aiming for a career in neurology receive a broad non-neurological training prior to the narrow disciplinary training of his postgraduate years. However, neurological faculties should decide what is the minimum neurological information and skill needed by a man who has just received his M.D. degree, regardless of what career he may enter in medicine. This operative definition of curricular content for undergraduate neurology may be given the term "core curriculum" depending upon how people define the term. However, such a compendium of information necessary for any physician about to enter any field would allow a neurological faculty to develop criteria to estimate the adequacy of their neurological teaching. Such a statement of minimum neurological information necessary will in no way inhibit the

addition of embellishments in neurological teaching during elective time for certain students.

A more sinister problem lurks behind the term "core curriculum". Implicit in the term is the fact that the faculty plans to develop a well organized "lock-step" curricular program. In this type of program the information imparted to every student is detailed for every week, even every day and hour in the attempt to assure that the "core curriculum" is presented prior to graduation in every discipline. This approach denies individuality in students' speed of learning and variation in mode of learning. It does not take into consideration the varied backgrounds and interests of students within the school. This type of program prevents students and faculty from dwelling on interesting side issues if the opportunity so presents itself. The "lock-step" curriculum encourages teaching by lecture series and demonstrations since freer forms of teaching would run great risks of ruining the schedule. Integrated curricula in neurosciences have been created in medical schools throughout the country, but they seem to rely heavily on lecture-demonstrations.

This leads to a consideration of the next problem in neurological education; the choice of teaching method.

TEACHING METHOD

The practice of neurology or neurological research implies performance in problem solving and investigative techniques. Our methods should teach by involving the student in performance as he learns not by passive instruction. "The best performance is built upon sound information;

but the provision, or even acquisition, of sound information is not assurance that it will occur." (13)

GOALS

As obvious as the need for a goal may seem in any endeavor, be it playing a game, driving a car, doing battle, creating a work of art, designing an experiment, writing an article, etc., enough attention is not paid to what is and is not a goal and what are the characteristics of a good goal. Without good goals the appropriate teaching methods and informational resources can certainly not be agreed upon. Without goals the decision can be made only by personal preference for a system, a method implied by the program of neurological education in many schools. (15) Of greater importance is the fact that without a satisfactory goal it is impossible to design suitable methods for evaluating student performance and the program's effectiveness in teaching. Mager makes it clear that despite what we may think is the goal of an educational program, the only worthwhile goal is in terms of what we expect to happen to the student after having been exposed to the program. (11) It is not important to worry about what we need to teach but instead, what the student learns. If you say that your course plans to cover "the details of the neurological examination and the symptoms and signs of neurological disease etc.", you are not describing goals, you are giving a course description. You can change and say that your course goals are to "have the student learn the neurological examination and understand the symptoms and signs of neurological disease etc. etc.". This is a goal but it is unable to convey

any specific meaning for the faculty or students because of its vagueness. Unless the goal is described in terms of behavior expected of the student at the end of the program, no one can determine whether the goal has been achieved and to what degree. We can then change again and say that the goals of our program are these: "the student should be able to perform a satisfactory neurological examination and demonstrate an understanding of the symptoms and signs of neurological disease."

Now everyone should certainly understand what we expect the student to learn and how we expect the student to behave on completion of the course. This is certainly an improvement. There is no question that consideration of these goals will certainly help in the design of teaching methods and informational resources necessary to accomplish these goals. We can more easily determine how to effectively examine the student and see if he has achieved these goals. Moreover, to satisfy the demands for really good goals requires the following. First of all, to best enable the faculty and the student to evaluate goal achievement, the goal should describe how the behavior change expected should be demonstrated, i.e. "write a list of" -- "solve a" -- "enumerate" -- "perform a" -- "construct a" -- etc. The goal should also imply how this demonstration will indicate goal satisfaction if at all possible. In addition, goals must be more specific, utilizing such works as "write," "identify," "differentiate," "solve," "construct," "list," "compare," "contrast," etc.

Concern for goals should make it apparent that we expect the student to do something beyond stuffing information into his cerebrum.

We expect him to perform, analyze, synthesize, make decisions, communicate, etc. etc. If you consider what you want your educational product to do with his neurological knowledge, it must be more than answer questions and list facts about the field. In this light, lectures and slides, demonstrations and films certainly must not play a principal role in education. We must, as teachers, help him perform, analyze, solve, communicate using factual information as armamentarium. Good goals make the decisions as to what are the more appropriate teaching methods more effective.

In designing proper goals for students we should consider the end product, the graduating physician, and define his terminal behavior in terms of neurological knowledge. Likewise in postgraduate training we should probably consider the behavior we expect of the neurologist. It is important that the goals for each level be agreed upon and spelled out in behavioral terms. Decisions should be made as to which goals relate to undergraduate and which goals relate to postgraduate training. Goals in undergraduate training should be spelled out in detail for other types of practitioners who, although not neurologists, will have to deal with neurological disease in their careers.

EVALUATION

The most crucial problem in neurological education is the overall problem of evaluation. Used here, the word has a broad connotation including evaluation of student achievement (tests, exams, etc.) evaluation of program effectiveness, evaluation of teaching methods and evaluation of

hypotheses concerning learning and the learner.

Discussions concerning the value of audio-visual aids, self-instructional aids, lectures versus seminars, practical experience versus didactic teaching, bedside teaching versus demonstrations, basic science orientation versus clinical, rigid curricula versus free, etc. etc. will only be conjectural, anecdotal, guess work and emotional until more evaluations are done, preferably, in a controlled manner.

However, as it is true that a teaching program cannot have true direction without good goals, it is equally true that you will never be able to evaluate students, teaching or the effectiveness of the program unless your evaluation techniques actually test the goals of the program. We would like to know whether the student can utilize the information in his work, either clinical or experimental. We would like to know whether he can use it when the appropriate situation arises or whether he will recognize the appropriate situation when it is in front of him. We also want to know whether he possesses sufficient skills in performance of history taking, examination, developing patient rapport, recognizing the effects of family, society, culture, etc. on the patient. These are certainly the goals in clinical neurological teaching and they must be tested by some other method than paper work or reports.

We should concentrate our efforts on better evaluation methods to measure what it is we decide the medical student or neurologist should represent in terms of their behavior, skills and attitudes. Until then, all problems of methods, media, curricula, time and varieties of experience in any teaching program are conjectural and decisions can only be

made by empirical methods.

SOME EXPERIMENTAL APPROACHES TO THE PROBLEM OF NEUROLOGICAL EDUCATION

CURRICULAR CHANGES

Some of the educational changes involved in the curriculum revision at the University of Southern California School of Medicine relate to the neurosciences and clinical neurological teaching programs. This medical school has made patient care its stated goal. This goal distinguishes the M.D. Degree from other postgraduate degrees. With patient care as an overall organizing goal in the program, it seems important the patient should be introduced from the very beginning of medical school. The plan evolved to offer clinical teaching and basic science teaching in a parallel fashion over the entire four years of medical school, instead of emphasizing basic science teaching in the first two years and clinical teaching the last two years. The clinical and the basic science content is to be correlated, emphasizing the need for information from the basic sciences to understand and cope with the problems of clinical medicine. Also important in the curriculum is the development of increasing periods of elective time in which the student could develop his interests hopefully in preparation for his career goals. Towards this, the student would have a tutor from the faculty to serve as a counselor , teacher and resource person. Basic science teaching will be primarily done by virtue of well prepared specimens and demonstrations since it is not felt that the ability to dissect or handle scientific apparatus is a goal for primary basic science teaching. However,

every student will be responsible for initiating a research project whether it be biological, social or clinical in his second year that would continue on through the rest of his school years. Hopefully this project would be again consistent with his career goals and the future neuroscientist would pick a project related to this career choice. Here is the opportunity to teach the student the problems of research design, performance and evaluation procedures required for the application of information to the scientific method. Another goal in this particular endeavor is to allow the student to develop an appreciation of what goes into the preparation of a research project so that he more effectively evaluates the literature in his self-study. Great emphasis in this curriculum is being put on the use of self-educational devices because it is felt that the student not only should develop an increased responsibility for patient care but also an increasing responsibility for his own education. In the first year the student will be exposed to clinical presentation of major symptom complexes of nervous diseases such as hemiplegia, seizure disorders or headache, etc. and at the same time he would be getting neuroanatomy, neurophysiology, neurochemistry in an integrated program providing primarily an orientation and overview to achieve an understanding of the symptom complexes shown in the clinical presentations. Again in the second year the student will be involved with patients showing the various varieties of neurological disease and again in the parallel neuroscience time coordinated with the clinical presentation he will be offered more sophisticated information in neuroanatomy, neurophysiology, neuropharmacology and neuropathology. In

the third year he will again be exposed to neurological patients in the format of the clinical clerkship in which he will behave in a position almost as responsible as the intern. Here again, he will receive seminars in relative basic science and in those aspects of basic science which are at the frontier and perhaps not particularly pertinent to the understanding of neurological disease at the present time but may be important to the future. The neurological faculty through the opportunity provided by the contract is designing elective experiences that would be appropriate for the student who has chosen a career in neurology or in some of the related specialties.

In this approach can be seen an attempt which affects neurological teaching with the emphasis more upon the performance of the student and the responsibility of the student for developing his own abilities and self-education. It stresses the close integration of basic science and clinical science as one process in medicine.

Evaluation is a very crucial issue and the mechanisms are being set up now to evaluate whether the new curriculum does indeed improve the performance of the medical student relative to goals for him.

CLINICAL GOALS

We have attempted to determine what are the proper goals for the third year clinical clerkship in the Department of Neurology at the University of Southern California School of Medicine. This is a three-week clerkship on the neurological services of the Los Angeles County/University of Southern California Medical Center. They are certainly not perfect but they have been very helpful, as far as they go, in allowing us to determine

what may be appropriate methods for teaching and evaluation.

A. The student must be able to perform a neurological history on the patients assigned to him that demonstrates an ability to elicit:

   (a) the earliest onset on the neurological disease,

   (b) the temporal profile or natural course of the neurological symptoms and signs,

   (c) the exact subjective nature of the patient's symptoms,

   (d) a complete survey of all possible neurological symptoms that may contribute to an understanding of the patient's history,

   (e) a family history.

B. The student must be able to perform a complete bedside neurological examination on his patient (measured against film loops developed as an educational resource).

C. The student should be able to perform a detailed examination of signs of nervous system dysfunction elicited in his overall examination of the patient. In essence he should show that he is able to "cone down" on the appropriate part of the neurological examination that relates to the patient's illness.

D. The student should be able to write a legible and organized patient report that contains all of the pertinent findings in the neurological history and the examination.

E. The student should be able to synthesize the data obtained from this report into a logical construction of:

(a) the anatomic localization of the neural dysfunction and its extent,

(b) the physiological or functional derangement present .

F. The student should be able to prepare a diagnostic impression and a differential diagnostic list based on:

(a) statistical probability,

(b) treatability.

G. The student should be able to describe the pathological changes expected in the patient's nervous system based on his principal diagnostic impression.

H. The student should be able to describe all the laboratory and diagnostic procedures that have been performed on the patient including:

(a) the reason for their performance,

(b) the results of the procedure,

(c) the contribution this procedure makes to an understanding of the patient's illness and its management,

(d) the risks of the procedure.

I. The student should be able to list other procedures that may be necessary to achieve a proper understanding of the patient's diagnosis or to make a decision in the patient's management:

(a) stating the reason for the performance of the procedure,

(b) stating the contribution that the results of this procedure will make to an understanding of the patient's disease,

(c) the risk of the procedure.

J. Assuming that the student's diagnostic impression is correct, he is expected to describe:

(a) a treatment or management plan for the patient,

(b) prognosis.

K. The student should be able to perform a lumbar puncture demonstrating:

(a) proper technique,

(b) recognition of the contraindications to the technique,

(c) ability to perform a cell count, Pandy test and a proper evaluation of bloody spinal fluid.

These goals are based on what we feel any person possessing a medical degree ought to be able to do when faced with a patient with neurological disease. We are emphasizing performance and stressing that the student develop an ability to synthesize the problem and make decisions on information available. Since we are not trying to make neurologists out of every medical student, these goals are aimed primarily at the work-up of patients with cerebrovascular disease, seizures, headache, peripheral neuropathy and neuromuscular weakness. We cannot quantitate the student's performance against any of these goals. We can make a decision as to whether his performance in each of these goals is satisfactory or unsatisfactory, relative to our understanding of the overall goal; that is, the performance expected of a physician who is not necessarily going into the field of neurology.

This approach has demonstrated how detailed and extensive a working goals statement must be. A statement of goals for our overall

undergraduate and residency program is in process. However, these goals, already stated, have dictated our evaluation methods and informational resources.

EVALUATION OF CLINICAL PERFORMANCE (The Programmed Patient)

Since part of our goals with the third year medical students relates to the performance of a neurological examination and synthesis of findings into a logical concept of altered neuroanatomy or neurophysiology, oral or written examinations do not seem appropriate. A clinical test would be to ask the student to examine a patient and report the results. This however is unsatisfactory in terms of our goal because it does not permit evaluation of the student's technique and cannot accurately determine how effective the student's ability to take a history and perform a neurological examination might be since the findings on patients change every day. It is a common experience between residents and attending men that the same case may look completely different even though the examiners were both very competent. Changes in patient attitude, physician personality, fatigue and a number of other factors all are variables that can change the test in ways unknown to or unmeasurable by the examiner. This is inappropriate to accurate evaluation. The other limitation to using real patients is the fact that one patient cannot serve as a test for a number of students, necessary in evaluating student achievement. This is also necessary in evaluating the effectiveness of the faculty's teaching program. If all the students fail in the achievement of a particular goal, then the effectiveness of the teaching program can be questioned and appropriately

altered.

With the aid of this contract we have developed further a technique referred to as the "programmed patient" in which an actor is carefully trained in the simulation of an actual neurological case from the records of the department, chosen for its educational value and its appropriateness as a test. (2,3) This "programmed patient" is carefully taught how to respond like a patient in giving a history and responding to items of the neurological examination. The "programmed patient" is consistent from student to student. The student will be able to obtain certain items of history only with sufficient skill. Like actual patients, the "programmed patient" will volunteer certain symptoms or remember certain events in the past only when the appropriate questions are asked. The student's history and performance of a neurological examination is monitored on a closed circuit television tape. The "programmed patient" gives us an evaluation of the student's ability to develop rapport, his bedside approach to the patient, and the reaction of a patient to this student if he were a physician in terms of his manner, gentleness, concern for the patient, appropriate handling of bedsheets and gown, etc. etc. The student works up a "programmed patient" as if it were a patient on the ward service and writes a complete report. This report plus the report of the "programmed patient" is then given to a faculty member, who sits down and interviews the student at length to see if the student can provide the informational content necessary to satisfy the remaining goals in the clerkship. The student is asked to draw upon his basic science training in understanding the pathophysiology of the disease, describe the various laboratory procedures that have been

done, and what laboratory procedures he suggests should be done. It is felt that in this manner we have achieved a clinical evaluation which is objective and aimed at the goals of our clerkship, and allows us to evaluate the student's performance accurately. This technique is now being employed by all the members of the Department of Neurology and Neurosurgery at the U.S.C. School of Medicine. It has allowed us to identify problems in student performance that otherwise would never have been revealed in the clinical clerkship. Prior to the use of this technique, faculty frequently felt that the student's clinical performance was quite satisfactory and often could not distinguish between students. Since the inception of the "programmed patient," we have been able to detect many significant problems in history-taking, examination technique, ability to synthesize the problem, etc. This has been valuable both in terms of immediate feedback that is useful to the student, and in the design of our teaching program. The students frequently express the fact that this is the first time their clinical competence has really been examined. They express the feeling that this feedback is of great use to them in their future work with patients. This technique has never failed to identify the outstanding students, as they have gone on in medical school. The great majority of students, physicians, and other faculty members who have examined the "programmed patient" to see what the procedure is like, describe their surprise as to how easily they forget that this is not an actual patient, and that they become completely involved in the clinical problem. The only criticism this technique has received can be characterized by the comment, "a fake patient is not a substitute for a real patient,

and all clinical teaching should be based on real patients". This objection ignores the fact that the simulated patient can occupy an intermediate position between texts, lectures, protocol, slides and movie films on one hand, and a real patient on the other.

The "programmed patient" is a real, living, reacting human on whom the student can sharpen and perfect his clinical skills, and can be evaluated for his ability to perform in the clinical arena in a manner of considerable educational value, impossible to accomplish with actual patients. This method used over the past five years has proved to be an effective, objective means for the evaluation of clinical performance, as it has provided the student immediate feedback with valuable insight into the errors in his technique, manner and knowledge of neurology—information that could not have been obtained otherwise. Evaluation of this evaluation technique is based on the increased information it produces and its apparent accuracy.

WORKSHOP FOR THE NEUROLOGIC EXAMINATION

Here a simulated patient is used as a subject for demonstration and practice of techniques in the neurological examination in a small workshop consisting of a faculty member and a few students. After demonstrations by the faculty member, the student can work out his examination technique before he has to interview and examine the patients on the ward. The consequences of neurological disease and significance of neurological findings can be freely discussed by the faculty, and the simulated patient can be examined and re-examined. In this situation the student can practice his examination technique without the embarrassment that he might feel as a

neophyte in front of ill patients, and without concern for tiring or hurting a patient or aggravating his illness. Such embarrassment detracts from learning when dealing with patients.

The simulated patient can be examined over and over until the student's technique is sure and satisfactory to the instructor and himself. Also, all the necessary aspects of disease complications and prognosis can be freely discussed in front of the simulated patient without concern for his reaction to such information. Real patients used for clinical teaching are relieved of the burden of being subjects for teaching skills unrelated to their illness, its care and evaluation. Evaluation of this technique's effectiveness has not been accomplished as yet, but is planned.

TEACHING OF CLINICAL NEUROLOGY IN REMOTE AREAS

The neurology department was able to present a series of workshops in neurology in several postgraduate courses offered to physicians in situations where it would have been impossible to find real patients. In ten workshops, covering the gamut of important neurological conditions one simulated patient was used. She simulated thirteen different neurological patient problems. Her simulations were based on actual cases selected for their teaching value from the departmental files. Her presence in bed, in a patient gown, brought the physician's mind to bear on clinical medicine more effectively than slides, films or protocols could have done. As on bedside rounds, her case history was recited by a faculty member and then a member of the student group was asked to examine the patient for the group. His approach was observed and commented on by the student group and

faculty producing group participation in a truly workshop situation. The simulated patient effectively enacted coma, seizures, paralyses, sensory losses, reflex changes, blindness, etc. as required in the patients simulated. Many physicians commented on the realism of this performance by the "programmed patient" and how easily they forgot that they were not dealing with a real patient. Phenomena that could not be simulated as papilledema for example, were described to the examining physician for him to assume as present (if he sought the sign) or a photographic slide of the fundus was shown if available. The actual electroencephalograms, X-rays, electromyograms and laboratory data of the patient the "programmed patient" was simulating were given to the group as they requested them in their work up of the patient. In this manner, broad bedside clinical instruction could be offered to any group in a remote area using only one simulated patient and one instructor. Even in areas where patients are available, such a variety of illustrative problems are not likely to be found.

DEMONSTRATION OF BASIC CLINICAL NEUROLOGICAL AND NEUROSURGICAL PRINCIPLES BY THE USE OF THE "PROGRAMMED PATIENT"

As an extension of this workshop technique, the simulated patient is used in larger medical school classes to demonstrate principles and techniques used in evaluating patients in coma, with seizures, aphasia, back pain, etc. In one such program developed in a "programmed patient," the patient was trained to simulate the successive changes in consciousness of a patient suffering from a subdural hematoma. (9) The "programmed patient" was able to simulate the changes that occurred over a fifteen-hour

period. In the class, a student was asked to come and evaluate the patient, examine the patient, and report his findings to another student acting as the physician, who was to replace him in a few hours. Then the "programmed patient" would simulate the next stage of this patient with a subdural hematoma, and the second student was asked to evaluate the patient and compare his evaluation with the report of the previous student. Again, in this very creative use of the "programmed patient" a tremendous amount of detail about the clinical procedure can be taught without concern for the subject, and in a compressed period of time. The student is actually working in clinical problem solving.

OTHER USES OF THE PROGRAMMED PATIENT

Kretzschmar, at the University of Iowa, has developed a "programmed patient" technique to teach interview techniques in obstetrics and gynecology. (8) Jason has developed the use of the "programmed patient" to teach interview techniques in the first year of medical school at Michigan State University. (7) The "programmed patients" trained in our department have been used for the production of programmed tapes on interview technique in psychiatry, the creation of medical educational TV programs demonstrating clinical phenomena as in the headache patient, accident victim and stroke patient. The "programmed patient" has a unique advantage in that they can be trained to accurately simulate a clinical condition and yet be utilized in a studio to the best visual advantage for putting across information. Patients are difficult in these situations, and ill patients impossible because of the excessive time, fatigue, lighting and rehearsal

demands necessary for a good production. Quite frequently, physicians were unaware of the fact that these were simulations even though the credits in the program made it clear.

SELF-INSTRUCTIONAL CARTRIDGES ON THE NEUROLOGICAL EXAMINATION AND ON THE MANIFESTATIONS OF NEUROLOGICAL DISEASE

Since the neurological examination cannot be effectively taught by the printed word, diagrams, or illustrations, because of its temporal and spatial aspects involving motor and perceptual skills, we turned to motion pictures as a solution for our problems in teaching the neurological examination. It was necessary to teach the neurological examination to eight interns every four weeks, four medical residents every two months, seven medical students every three weeks, and at many other times in post-graduate and resident training programs. Static forms of instruction seem inappropriate for teaching such skills, and the valuable and time-honored method of demonstrating a neurological examination presents an over-whelming amount of information at one time and gives a student little to which he can refer later when he encounters a problem in the neurologic examination he is performing. Members of the neurology teaching staff are often not present or freely available to offer help at the most valuable time, the moment when the student encounters a problem. In addition, any one demonstration of the neurological examination that would cover all the important principles necessary to understanding the neurologic examination must be tediously long. This fact, which inhibits the value of the neuro-logic demonstration, also prevents motion picture films from being the ideal medium.

We have used the four-minute self-instructional film cartridge to solve this problem since it can be conveniently used for short visual reference exactly like a printed textbook. All the details of a complete neurological examination performed on a normal subject were documented on 16 mm. color film and then reduced to 8 mm. film in four minute self-instructional cartridges. These cartridges are divided by natural divisions in the neurologic examination and repeat themselves over and over again in the projector if not turned off. The reduction from 16 mm. to 8 mm. leaves the original 16 mm. stock for use in the development of other teaching films and increases the detail on the 8 mm. film.

The film uses brief titles to identify each subject or procedure reserving textual material, diagrams and charts to an accompanying protocol that the student can study at length. An accompanying syllabus contains all the information necessary to understand the background of all the procedures used in the neurological examination, and it utilizes the same titles and is organized in the same order as the cartridges.

All this material needs more prolonged study than would be practical on the film. On every page of the syllabus there is a symbol identifying the specific cartridge with which it correlates. The syllabus has illustrations based on film scene so that it will have continuing value to the student as a text on the neurologic examination. This results in a visual textbook on the neurologic examination in four minute paragraphs. If the student becomes concerned about a part of the neurological examination that is not clear to him or would like to have more detail on how to "cone down" on a particular area of the neurologic examination, all he has to do

is go to the film cartridges which are present on the neurological wards, available to interns, students, and residents, and identify the cartridge on which the information he seeks is contained. He puts this cartridge in the projector, and in four minutes the subject is reviewed for him conveniently and quickly. This is just as if he had taken a book out of the library and read the paragraph of the reference material he needed.

We are presently documenting all the abnormal manifestations of neurological disease for cartridges as well, so the student will be able to identify the abnormal neurological manifestations his patient may be showing. The result will be a visual library on the symptoms and signs of neurological disease. The projector used with these cartridges is very portable and can be used by the student in any place he wishes for review and study. The 22 cartridges on the neurologic examination allow us to cover the bedside neurological examination in complete detail.

We are presently involved in an evaluation procedure to test the effectiveness of these cartridges in learning. The clerkship students come in ten groups of seven students. Last year half of these groups used the self-instructional cartridges as an available information resource and the other half did not, on the basis of random numbers. The reason given to groups who served as a control was in terms of equipment breakdown. Matched groups (Figure 1) of those who did get the cartridges and those who did not get the cartridges were tested with the same "programmed patient" at the end of their clerkship. The same students are again being tested when they enter the neurosurgical clerkship in their senior year to evaluate the retention of information and skills on the neurologic examination.

In order to evaluate student performance on the procedures used in examining the "programmed patient," a 75-item questionnaire (Figure 2) was developed to be used by the "programmed patient" upon completion of the student's 30-minute examination. The results of this were scored and the scores summarized (Figure 3).

Taking the number of incorrect responses of the collective matched groups (experimental vs. control) and relating these to the number of correct responses on the questionnaire, we were able to obtain a percentage of incorrect to correct responses (Table 1).

TABLE 1

The Performance of Groups in the Physical Examination

	No. of Procedures*	No. of Correct Procedures	No. of Incorrect Procedures	Percentage of Incorrect Procedures
Experimental	1465	1380	85	5.80
Control	1534	1452	82	5.34

*Difference between Experimental and Control is due to a larger number of subjects in the control group.

Inspection reveals that differences are slight and by statistical standards "non-significant" at standard levels.

On the assumption of an experimental hypothesis - there is a standard statistically significant difference in performance between a group having the use of the self-instructional cartridges and a like group who did not

have their use - the data require that we reject this hypothesis and accept the null hypothesis.

Figure 1

SCHEDULE OF NEUROLOGY CLERKSHIPS

Clerkship	Dates	Film	Exam
1	9/12 - 10/2	No	A
2	10/3 - 10/23	No	B
3	10/24 - 11/13	No	C
4	11/14 - 12/4	No	D
5	12/5 - 1/8	Yes	A
6	1/9 - 1/27	Yes	B
7	2/6 - 2/26	Yes	C
8	2/27 - 3/19	Yes	D
9	3/20 - 4/9	No	E
10	4-10 - 4/30	Yes	E

Figure 2

USC NEUROLOGY PROGRAMMED PATIENT PROJECT EXAMINEE REPORT

Examinee _____ Date _____
Examiner _____ Hour _____
Case # _____

OK NG MENTAL EXAMINATION

___ ___ Orientation (place-time-name-etc.) _____
___ ___ Memory (birth-dates-age-etc.) _____
___ ___ Abstraction (proverbs-etc.) _____
___ ___ Intellect (facts-numbers-etc.) _____
___ ___ Judgement (Decision-solve problems etc.) _____

APHASIA TESTING

___ ___ Follow instructions _____
___ ___ Write _____
___ ___ Name objects _____
___ ___ Repeat _____
___ ___ Read _____
___ ___ Speech _____
___ ___ Mimic _____
___ ___ Other _____

SMELL

___ ___ Together _____ Nose released early _____
___ ___ Eyes open _____ Scent used _____

VISUAL ACUITY (reading)

___ ___ Snellen Chart _____ Together _____
___ ___ Newsprint _____ Other _____

VISUAL FIELDS (fingers move in four fields)

___ ___ Together _____ Not in four directions _____
___ ___ Verbal instructions unclear _____

OPHTHALMOSCOPE

___ ___ Not dark Directions unclear _____
___ ___ Vision obscured Other _____

___ ___ PUPILLARY REACTION TO NEAR VISION _____

___ ___ PUPILLARY REACTION TO LIGHT _____

___ ___ EYE MOVEMENTS (follow object in all directions of gaze) _____
Not in four directions _____
Other _____

___ ___ ASK ABOUT DOUBLE VISION _____

Figure 2 (Cont'd)

SENSATION OF FACE TO: ☐ TOUCH ONLY ☐ PIN ONLY ☐ BOTH
- ☐ Forehead _____ ☐ Cheek _____
- ☐ Chin _____ ☐ Not compared _____
- ☐ Eyes not closed _____

CORNEAL REFLEXES _____
- ☐ Lashes only _____ ☐ White not touched first _____
- ☐ Verbal instructions unclear _____

CHEWING STRENGTH _____

JAW REFLEX _____

MOVEMENTS OF FACE _____
- ☐ Wrinkle brow _____ ☐ Eyes closed _____
- ☐ Show teeth _____ ☐ Smile _____
- ☐ Did not try to open tightly closed eyes _____

HEARING _____
- ☐ Watch _____ ☐ No bone conduction _____
- ☐ Tuning fork _____ ☐ No air conduction _____
- ☐ Rubbing fingers _____ ☐ Other _____

GAG REFLEX _____
- ☐ One side only _____ ☐ No light used _____
- ☐ Middle _____ ☐ Sensation not compared _____

CATCH PHRASES _____

INSPECT TONGUE (loose in bottom of mouth or stuck out) _____

CHECK TONGUE MOVEMENTS _____

STRENGTH OF HEAD TURNING (push against hand with face) _____

WALKING _____
- ☐ Normal _____ ☐ Heel _____
- ☐ Tandem _____ ☐ Toe _____

STANDING _____
- ☐ Eyes open _____ ☐ Eyes closed _____

ARM EXTENSION _____
- ☐ Eyes not closed _____ ☐ Rebound not tested _____

Figure 2 (Cont'd)

☐ ☐ FINGER TO NOSE _____

☐ ☐ RAPID FINGER MOVEMENTS _____

☐ ☐ RAPID ALTERNATING MOVEMENTS _____

☐ ☐ HEEL TO TOE (run heel down shin) _____

☐ ☐ SEARCH FOR MUSCLE ATROPHY _____

☐ ☐ SEARCH FOR MUSCLE FASCICULATION _____

TEST STRENGTH OF THE FOLLOWING MUSCLES (PUSH AND PULL):

☐ ☐ NECK (turn head against hand or foreward and backward) _____
☐ ☐ SHOULDER (shrug shoulders or arms out straight to side)_____
☐ ☐ ELBOW(elbow bent and push-pull)_____
☐ ☐ WRIST _____
☐ ☐ FINGERS _____
☐ ☐ CHEST (breathing)_____
☐ ☐ ABDOMEN (sit up as watches stomach or feels it) _____
☐ ☐ HIP (knee to chest or push with leg etc.) _____
☐ ☐ KNEE _____
☐ ☐ ANKLE _____

TEST SENSATIONS:

☐ ☐ PIN _____
- ☐ Above and below not compared _____
- ☐ Both sides not compared _____
- ☐ Serial head to toe not checked _____
- ☐ Back not done _____
- ☐ Other _____

☐ ☐ TOUCH _____
☐ ☐ VIBRATION _____
☐ ☐ POSITION _____
☐ ☐ TWO POINT _____
☐ ☐ TEMPERATURE _____
☐ ☐ OBJECTS OR NUMBERS IN HAND _____
☐ ☐ OTHER _____

TEST REFLEXES:

☐ ☐ BICEPS _____
☐ ☐ TRICEPS_____
☐ ☐ FINGER_____
☐ ☐ KNEE_____
☐ ☐ BETWEEN EYES_____
☐ ☐ STROKING HAND_____
☐ ☐ ANKLE (knee bent)_____

☐ ☐ BABINSKI (bottom of foot)___
☐ ☐ GORDON (squeeze calf)____
☐ ☐ OPPENHEIM (shin rub)_____
☐ ☐ CHADDOCK (side of foot)___
☐ ☐ SUPERFICIAL ABDOMINAL___
☐ ☐ DEEP ABDOMINAL_____
☐ ☐ OVER MOUTH_____

Figure 2 (Cont'd)

STRAIGHT LEG RAISING _____
NECK BENDING _____
ROMBERG (stand feet together eyes closed) _____
PALPATE AND FEEL FOR NERVES AND VESSELS _____

☐ Elbow _____ ☐ Knee _____
☐ Neck _____ ☐ Foot _____

USE OF EQUIPMENT:

HAMMER _____
PIN _____
TUNING FORK _____
SHEETS _____
LIGHT _____
OTHER _____

CHECK EXAMINERS ATTITUDE:

COMPETENT _____
INSECURE _____
PUZZLED _____
HESITANT _____
PLEASANT _____
REASSURING _____
COLD _____
BRUSQUE _____
TOO FUNNY _____
TOO SERIOUS _____
OTHER _____

EXAMINERS APPROACH:

INTERESTED _____
COURTEOUS _____
NO OPENER _____
NO INTRODUCTION _____
OTHER _____

EXAMINERS MANNER:

ROUGH _____
GENTLE _____
FEARFUL _____
REASSURING _____
OTHER _____

WERE YOUR COMPLAINTS MORE THAN ROUTINELY INVESTIGATED?___
_____
_____
_____

Figure 2 (Cont'd)

☐ DO YOU FEEL YOU WERE SUFFICIENTLY DISROBED FOR A COMPLETE SURVEY OF:

- ☐ Sensation _____
- ☐ Muscle atrophy _____
- ☐ Muscle fasciculation _____

☐ WERE YOU DOUBLE CHECKED FOR VAGUE, UNUSUAL, OR EQUIVOCAL RESPONSES? _____

_____

_____

DID YOU MAKE ANY MISTAKES? _____

_____

_____

_____

_____

_____

_____

SPECIAL QUESTIONS AND COMMENTS _____

_____

_____

Figure 3

(Control)
NEUROLOGY CLERKSHIP #_____

RATINGS:

Excellent	5
Good	4
Fair	3
Poor	2
Unacceptable	1
None	0

Student	History and Write-up	Exam	Dx	Diff	Rx	Work-up	Total
1							
2							
3							
4							
5							
6							
7							
8							
9							

(Experimental)
NEUROLOGY CLERKSHIP #_____

RATINGS:

Excellent	5
Good	4
Fair	3
Poor	2
Unacceptable	1
None	0

Student	History and Write-up	Exam	Dx	Diff	Rx	Work-up	Total
1							
2							
3							
4							
5							
6							
7							
8							
9							

FUTURE PROJECTS

We would like to develop the programmed patient as a pretest in postgraduate neurological education, to demonstrate the student's educational needs in the teaching program and to show to the student his own weaknesses and his need to acquire certain skills and abilities. The results of this clinical pretest would select the informational resources the student needs to study and the types of patient problems with which he needs to have experience. When the course of study, preferably self-study and clinical work, is completed several selected "programmed patients" could be used to test achievement of the student and the need for more work. This undertaking will require careful compilation of goals in postgraduate neurological training and an extensive source of informational resources both clinical and archival, so that the students' needs can be accurately programmed. The use of these resources can be designed to suit the student's speed and best mode of learning. This program consisting of carefully stated goals and carefully designed evaluation procedures should allow flexibility in teaching producing a program tailored to the student. The success of such an undertaking depends ultimately on careful postcurricular evaluations at a time distance, probably similar to the approach of Gardner et al (6), and possibly utilizing the "programmed patient" in a hospital or private office setting.

Also implicit in this undertaking is the compilation of a protocol that carefully documents the various advantages and disadvantages to each instructional medium as it relates to educational uses in the medical setting.

This step, necessary for efficient development of informational sources is already in progress. This program can be expanded to involve other post-graduate students in other disciplines related to the neurological patient's management who must work together as a team. In this way, needs that develop as a consequence of the team approach can be identified and the appropriate educational approach designed. This could have significant yield in approving the efficiency and effectiveness of these professionals in the management of neurological diseases. Finally such an approach can be extended into the undergraduate neurological curriculum. Here more imaginative pre and post tests need to be designed for the basic neuroscience programs where performance and information application by the student is assayed as in the "programmed patient". This may entail the creation of programmed experimental models. Such need-oriented, self-educational programs in neurology could conserve faculty time and maximize the student's time in a manner personally designed for the student and flexible in terms of teaching methods. If the students and faculty document the course goals beforehand; if tests that accurately test these goals are designed; and if the informational and experience resources are readily available at any time; the student and faculty can design the teaching methods to suit themselves.

SUMMARY

This report describes the reasons for the growing concern among neurologists about predoctoral and postdoctoral neurological education. Neurological education is described as a scientific discipline related to the

field of education that needs to be studied and augmented by neurologists involved in teaching. Principles evolved from education as an applied, and presently quite empirical discipline need to be used in neurological teaching programs to improve their effectiveness. The first part of the report deals with a number of important problems in neurological education, motivation, informational resources, teaching methods, core curriculum, educational goals and evaluative techniques. Each is defined and its relationship to neurological educational programs described. Goals, in terms of behavior expected of the student at the end of a neurological teaching program, coupled with evaluation techniques related to these goals, are felt to be the key factors in the design of a good program.

The second part of this report describes experimental approaches applied to neurological teaching in the areas of goals, evaluation techniques related to clinical goals and teaching methods developed to solve some of the problems met in local neurological educational programs.

Behavior and learning are subjects appropriate to the discipline of neurology. This fact coupled with the need for sophisticated educational programs in neurology underlines the need for more experimental approaches to education. This activity could contribute to the overall need in medical education for more scientifically valid data.

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CALIFORNIA CHAPTER
THE MYASTHENIA GRAVIS FOUNDATION, INC.
237 S. CATALINA ST. • LOS ANGELES, CALIF. 90004 • TELEPHONE 385-4174

July 24, 1969

APPENDIX 1

Howard S. Barrows, M.D.
Professor of Neurology
USC School of Medicine
2025 Zonal Avenue
Los Angeles, California 90033

Dear Howard:

The MG teaching film has been of inestimable help to the Foundation in bringing the story of myasthenia gravis to the physicians not only up and down our State but also across the country.

Since the film was released there have been 655 viewings in Hospitals, 62 showings in Medical Schools, and 38 showings in Schools of Nursing. In addition to these showings we have had the film shown at two meetings of the American Association of Neurology (AAN) and at three meetings of the Federation of Western Societies of Neurological Science. There have also been two viewings by State Medical Societies.

In my opinion, since the audiences range from 18 to several hundred, more than 12,000 physicians and paramedical people have viewed the film "Myasthenia Gravis". The expressions of approval that I have received from physicians have all been favorable. In most instances the viewers have used the expression "excellent presentation and extremely helpful".

You should know that our experience has indicated that diagnoses of MG cases follow shortly after viewing the film. We know that lives have been saved and patients helped because of this magnificent tool that we use in our physician Program.

We express our gratitude to you for your help.

Cordially yours,

Harold Rosenberg
Executive Director

HR:cn
Encl.

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APPENDIX 3

Simulated Patients in Medical Teaching

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MOCK warfare, mock trials and aircraft trainers are but a few examples of simulation used to teach, evaluate and provide practical experience for the student before he is ready to assume full responsibility. Simulated teaching is controlled, the student's experience is free of unexpected or unknown variables, and his responses or actions can be recorded and evaluated relative to performances by other students and the goals of the teacher. Over the past three years we have developed patient simulation in many areas of medical education to teach and evaluate clinical performance by the student. To teach patient care is the stated goal of our medical school and certainly a goal implied in the M.D. degree. Despite this, it is amazing how few means are available in medical education to appraise accurately the performance of a physician-to-be at the bedside and to teach clinical medicine in a simulated or controlled situation that provides experience dictated by the teacher.

For patient simulation we use persons who have been specially trained and oriented to perform as patients. In many instances this requires that they should give a history and simulate the clinical findings of a patient with a particular disease entity.

Advantages of the Simulated Patient

The simulated patient has the following advantages over the use of real patients in the teaching situation:

1. The student can practise examination technique on simulated patients without the embarrassment a neophyte feels in front of ill patients and without concern for tiring them, hurting them, or aggravating their illness.

2. The simulated patient can be examined over and over until the student's technique is sure and satisfactory to the instructor and himself.

3. All necessary aspects of disease complications and prognosis can be freely discussed in front of the simulated patients without concern for their reaction to such information.

4. Real patients who are used for clinical teaching are relieved of being subjects for teaching skills unrelated to their illness, its care and evaluation.

5. A clinical problem can be presented to a student in which all the findings can be predetermined, allowing for careful evaluation of the student's clinical ability.

6. The same clinical problem can be presented again and again to different students, allowing for inter-student comparison and for evaluation of the effectiveness of the teaching program.

7. A trained simulated patient can report objectively on the student physician's skills, physician-patient rapport, manner, approach, etc.

The objection to the simulated patient can be stated as follows: "A fake patient is no substitute for a real patient. All clinical teaching should be based on real patients." This objection ignores the fact that the simulated patient can occupy an intermediate position between texts, lectures, protocols, slides and movie films on the one hand and a real patient on the other. He or she is a real, living, reacting human on whom the student can sharpen and perfect his clinical skills and be evaluated for his ability to perform in the clinical arena.

Training of the Simulated Patients

The details of the training of simulated patients will not be included here, since they have been described elsewhere.[2] Basically the training program consists of any or all of the following steps, depending on the specific use of the simulated patient:

1. Orientation to the clinical setting and the simulated patient technique (films and demonstrations are utilized in this phase).

2. Employment as subjects in class demonstrations of anatomy, examination techniques, etc.

3. Observation, by simulated patients, of real patients being interviewed and examined, especially patients showing phenomena to be presented by the simulated patient.

4. Teaching the simulated patients to make a real patient's clinical problem their own. They learn the patient's experience with the disease

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process and how to simulate the findings expected in a patient.

5. Coaching the simulated patient to behave in the interview and at examination as a patient (for this phase we now use an experienced patient simulator who is a professional actress).

6. Independent evaluation and critique of a trained simulated patient's performance by a member of the teaching faculty who has had no contact with the training program.

PRESENT USES OF THE SIMULATED PATIENT

A. *Laboratory in Living Anatomy*[1]

The anatomy that should be taught to freshmen is living anatomy. It is important to have the student apply the information he learns from the cadaver to the living human body. At the end of each major section in gross anatomy, e.g. the thorax, abdomen, extremities, etc., the students spend time in a clinic-laboratory where the simulated patient can be examined, under faculty supervision, for bony landmarks, musculature, tendinous insertions, palpable organs, vessels and glands. They can perform skin mapping of underlying viscera and observe functional phenomena related to anatomical structure, e.g., joint motion, muscle action, respiratory and cardiovascular movements. In this manner the students correlate cadaver information to a living subject. In this contact with disrobed simulated patients the student can overcome any embarrassment and concern from such an encounter early in his career, so that objective attitudes can be developed, allowing the student to learn more effectively from subsequent patient encounters. This clinic-laboratory has gained enthusiastic acceptance by all students and faculty concerned.

B. *Teaching Clinical Neurology in Remote Areas*

The Neurology Department was able to present a series of 10 workshops in neurology as part of a postgraduate course offered to physicians in a resort hotel in Hawaii where it would have been impossible to find real patients. In all these workshops, covering the gamut of important neurological conditions, one simulated patient was used. She simulated 13 different neurological patient problems. Her simulations were based on actual cases, selected for their teaching value from the departmental files. Despite the holiday atmosphere, her presence in bed in a patient gown brought the physicians' minds to bear on clinical medicine more effectively than slides, films or protocols could have done. As on bedside rounds, her case history was recited by a faculty member and then a member of the student group was asked to examine the patient for the group. His approach was observed and commented on by the student group and faculty, producing group participation in a truly workshop situation. The simulated patient effectively enacted coma, seizures, paralysis, sensory losses, reflex changes, blindness, etc., as required in patients she was simulating. Physician after physician in this workshop commented on the realism of her performance and how easily they forgot that she was not a real patient. Phenomena that cannot be simulated—papilledema, atrophy, fasciculation, etc.—are described and the examining physician is asked to assume their presence. However, this was rarely necessary. The actual electroencephalogram, radiographs, electromyogram and laboratory data of the patients simulated were given to the group as requested. In this manner broad clinical instruction can be offered to any group in any remote area, using only one simulated patient and one instructor. Even in areas where patients are available such a variety of illustrative problems is not likely to be found.

C. *Evaluation of Clinical Neurological Performance*[2]

In the clinical clerkship in neurology our goals are to teach third-year medical students to perform a neurological examination, synthesize their findings into a logical concept of altered neuroanatomy or neurophysiology, arrive at a logical impression of etiology and differential diagnosis, and survey the case as a whole, utilizing laboratory and diagnostic procedures. Quizzes, oral or written, do not test these goals. Reporting the results of a real patient examination does not permit evaluation of the student's technique or comparison between students, since they all cannot examine the same patient. This type of test is fraught with variables in terms of the responses of a particular patient at any given time. The simulated patient can present a repeatable history, in the manner of a real patient, and repeatable neurological findings based on those of an actual patient. In addition, this simulated patient, especially trained, can subsequently report on the details of the student's examination technique and bedside manner. This method, used over the past three years, has proved to be an effective means for the evaluation of clinical performance and has provided the individual student with valuable insight into errors in his technique, manner and knowledge of neurology that could not have been obtained otherwise.

Again, many students described how easily they forgot this was not a real patient they were examining, as testimony to the realism of this procedure.

D. *Workshop in the Neurological Examination*

Here the simulated patient is used as a subject for demonstration and practice of techniques in the neurological examination in a small workshop consisting of a faculty member and a few students. After demonstrations by the faculty member the student can work out his examination technique before he has to face the real patient. The consequences of neurological disease and significance of neurological findings can be freely discussed by the faculty, and the simulated patient can be examined and re-examined without concern for his welfare or reaction, since he is hired to be a subject.

E. *Demonstration of Basic Neurological and Neurosurgical Principles*

As an extension of the workshop technique, the simulated patient is used in larger medical school classes to demonstrate principles and techniques used in evaluating patients in coma, with seizures, aphasia, back pain, etc.

F. *Other Uses*

Based on the advantages of simulated patients over real patients in teaching, there have been many other ways in which their services have been used. The psychiatry department utilized a simulated patient to prepare teaching tapes on the psychiatric interview. They have been used in the preparation of several films and educational television shows by many different departments. In one television show the simulation was so convincing that many clinicians in the audience felt they were watching a real patient with an aphasia and hemiparesis, despite a final credit mentioning the patient simulation. Here a patient was spared agonizing hours under hot lights with rehearsals and repeats; yet the audience had the illusion that they were actively involved in an acute medical problem. The simulated patient has been utilized recently as an evaluation technique for a clinical teaching innovation by offering the same test to paired experimental and control groups of students.

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APPENDIX 4

Self-Instructional Film Cartridges in Medical Education

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THE great advances in medical science over the past decades have greatly increased the amount and complexity of information and skills that must be offered to the medical student within his four years of medical school. As a result, there is an increasing burden on the faculty to develop new teaching methods that will more efficiently utilize the student's limited time with any particular discipline within medicine. This is especially true in the field of neurology. Self-study aids are important in this endeavour since they can be used independently of faculty time and at a time most convenient and useful to the student. This communication will discuss the development, use and evaluation of four-minute motion-picture cartridges as a convenient self-study aid for the neurologic examination.

The neurologic examination cannot be effectively taught by the printed word, diagrams or illustrations, because it is a temporal and spatial phenomenon involving motor and perceptual skills. Therefore, static forms of instruction are inappropriate for teaching such skills. The valuable and time-honoured method of performing the neurologic examination in front of students presents them with an overwhelming amount of information at one time. It gives the student little to which he can refer later when he encounters some problem in the neurologic examination he is performing on his patient. Members of the neurology teaching staff are often not present or freely available to offer help at the most valuable time: the moment when the student encounters the problem. In addition, any demonstration of the neurologic examination that would cover all the important principles necessary to understanding the neurologic examination would be tediously long. There are several good motion-picture films which illustrate the neurologic examination. However, they suffer the same limitations in time and quantity of detail that can be covered. Motion pictures are unsatisfactory for later reference; running through an entire 20- to 40-minute film to review a few points of information would be a prohibitive waste of time. To teach the neurologic examination more effectively, a "visual textbook" was developed, made up of self-instructional

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Fig. 1.—Self-instructional cartridge* about to be inserted into the portable projector.

*Technicolor.

Fig. 3.—Portable projector* for self-instructional cartridge and syllabus.

*Technicolor.

cartridges containing motion-picture films in short segments, not unlike paragraphs or chapters in a reference book.

THE LOOP FILM

Fifty feet (four minutes) of 8-mm. motion-picture film is contained in each self-instructional cartridge. The cartridge is a rigid, plastic container within which the film is permanently loaded as a continuous loop. A cartridge chosen for review by the student is inserted into the back of a portable projector (Fig. 1). When the projector is turned on, the contained film will be projected continuously, over and over, until the projector is turned off (Fig. 2). This entire operation requires no hand contact with the film or complex film-loading. Except for an occasional adjustment of focus and frame centring, the projector only needs to be turned off and on. When the student is finished, the cartridge is pulled out of the projector and filed. The projector is light and portable and can, with a zoom lens, project on to walls, screens, paper, etc., for personal study or small group review in almost any environment. Our projectors and film cartridges are located in a student study room on the neurological wards, available to students around the clock.

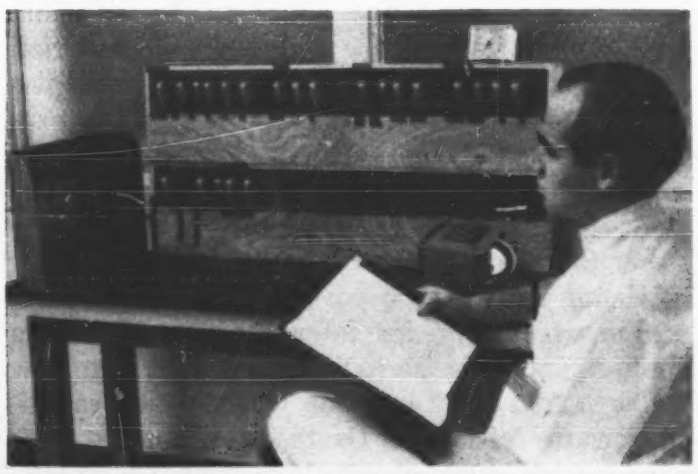

Fig. 2.—Self-instructional cartridge in use on the ward service.

All the details of a complete neurological examination, performed on a normal subject, were carefully documented by a photographer-neurologist team on 16-mm. colour film. Four minutes of 8-mm. film in the cartridge represents 100 feet of 16-mm. film. Therefore, the examination was edited into segments or "chapters" of less than 100 feet each. These 16-mm. segments are reduced to 8 mm. and loaded into the cartridges. This reduction preserves as much detail as possible on 8-mm. film and leaves original 16-mm. stock for use in the development of other teaching films. The films use brief titles to identify each subject or procedure. Textual material, diagrams and charts necessary to understand all parts of the neurologic examination were excluded from the film, so that the unique ability of the motion picture to demonstrate the technique of the examination was not hindered by didactic information.

An accompanying syllabus contains all the text, charts, diagrams, etc., necessary to give the student the background he needs to understand the significance of every step in the filmed examination (Fig. 3). Such material needs more prolonged study than would be practical when the student is using the film cartridge. The syllabus is organized by the same segments in the

same sequence and with the same titles as the film cartridges. On every page of the syllabus there is a symbol identifying the specific cartridge with which it correlates. The syllabus has illustrations based on film scenes, so that it will have continuing value to the student as a text on the neurologic examination.

Films demonstrating abnormal findings elicited on the neurologic examination of patients are now being edited for cartridges. These will provide a correlated group of cartridges on abnormal findings to complement each cartridge on the examination procedure. The final goal is a comprehensive visual library on neurologic examination technique and all the manifestations of neurologic disease, any part or parts of which will be available to students in neurology for study or review at any time or place.

EVALUATION

We have recently completed a year-long study to evaluate the effect of the self-instructional cartridges on medical students' effectiveness in performing a neurologic examination. The neurologic clerkship in the third medical year is three weeks long. In this clerkship we emphasize the neurologic examination, as well as skills in differential diagnosis, proper neurologic work-up and design of an effective treatment program. At the end of each three-week clerkship, the students are evaluated by the use of the programmed patient, a controlled clinical testing procedure that gives accurate information concerning the students' particular skills in the neurologic examination.[1] During the year, there are 10 clerkship groups. Selected by random numbers, some clerkship groups were given the self-instructional cartridges and others, who served as controls, did not have the cartridges. The clinical test offered by the programmed patient, although varied during the year, was matched for pairs of experimental and control groups. An initial evaluation of the data seemed to show that the use of the self-instructional cartridges in the clinical clerkship, with all other factors kept equal, did improve the quality of the students' neurologic examination. The students like these cartridges, and a timer attached to the projectors shows that they use these cartridges repeatedly.

Many more self-instructional cartridges are planned in our particular field of neurology: cartridges covering other examination skills, the use of diagnostic equipment, performance of emergency procedures and demonstration of basic science principles and phenomena. The value of these films in pediatrics, psychiatry, orthopedics, nursing, physical therapy and occupational therapy was readily apparent to our colleagues in other faculties, and teaching cartridges in these areas are now in the planning stage. These cartridges are a convenient study aid that can be utilized anywhere to demonstrate a phenomenon or procedures that are temporal and spatial.

Lastly, at least three commercial manufacturers prepare cartridges and projectors that use 8-mm. film with sound. Several of these provide satisfactory sound in the form of magnetic tape which allows a department with even a modest amount of equipment to narrate or add their own sound to cartridges they produce. These cartridges are larger and can accommodate a continuous loop of film that may run from two minutes to half an hour. The use of sound will eliminate much of the titling used in cartridges such as the ones described here, allowing more time for instructional film. Also, sound reinforcing the visual image may eliminate much of the textual material now necessary in the syllabus. However, four or five minutes seems like a very convenient length for a cartridge. Longer cartridge time may inconvenience the student, making him look at much material in which he may not be interested.

CONCLUSION

Our experience indicates that a self-instructional visual textbook can make a significant contribution to the education of medical students if the material to be filmed is selected for its teaching value, is carefully demonstrated and skilfully photographed. The old Chinese proverb "One picture is worth more than ten thousand words" is true only if the films clearly illustrate the points intended and do not contain confusing or distracting elements. Otherwise, the ten thousand words might be worth a great deal more. For use on a self-study basis, films and accompanying printed matter must be self-evident and self-explanatory, and appropriate to the student's stage of educational development. With these cartridges the student can learn more efficiently subjects otherwise limited by space and time. Furthermore, faculty time, that incredibly precious commodity, is conserved.

I would like to acknowledge the assistance of Dr. Stephen Abrahamson, Director, and his staff of the Division of Research in Medical Education in the development and evaluation of this project.

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Introduction of the Living Human Body in Freshman Gross Anatomy

APPENDIX
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by
H. S. BARROWS, P. R. PATEK, and S. ABRAHAMSON

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Introduction of the Living Human Body in Freshman Gross Anatomy

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Assuming that the objective of medical education is to equip the future physician with the ability to care effectively for patients, freshman gross anatomy in medical school is to be thought of as a basic discipline that will give the student an understanding of normal structure in the living human being. Although he studies and dissects cadavers in such a course, we are not attempting to make him an anatomist but, instead, we are asking him to transfer what he learns on the cadaver to the living body. Yet, the student is usually not provided with the opportunity to apply directly to the living person what he learns in anatomy at the times he learns it. He should be able to palpate skin, lymph nodes, muscles, tendons, bones and bony prominences, vessels, and other structures in the living human as he studies the internal anatomy and structural relationships in the cadaver. Whenever possible, he should see these structures studied in the cadaver move and function. In this manner a solid learning bridge between anatomical knowledge and his further pursuits in physical diagnosis and clinical medicine is formed. Physical diagnosis will be more readily learned if the student has been orientated not only to the cadaver anatomy of the areas to be examined on physical examination, but also to normal living anatomy. He can then more fruitfully spend his time on such phenomena as auscultation, percussion, and pathological manifestations.

Students' Difficulties

During the anatomy course the student usually develops an objective but respectful attitude towards the cadaver. Paradoxically, medical students do not seem to enter the clinical arena with the same objectivity concerning the disrobed human body. Embarrassment can not only impede their clinical learning, it can also affect their subsequent rapport with patients. Rapport is adversely affected not only in terms of their own attitude and behaviour, but also in terms of the patients' responses to the examiner's unspoken uneasiness.

Consequently, we recently made an attempt to introduce the living body into freshman anatomy as a subject for anatomical study by the students. In the past, the only real attempt at a correlation with living anatomy was to ask the students to examine each other. Such an approach is never satisfactory for many reasons. Embarrassment at disrobing among his peers inhibits the examinee's role and embarrassment for the examinee by the examiners distracts from learning. This is especially true when there is a difference in sex between examiners and examinees. The embarrassment, even if mild, not only inhibits simple observations, it precludes adequate palpation and probing by examiners.

Physicians are always hesitant to examine colleagues or members of their family for many of the same reasons that examination between medical students should be looked upon as unsatisfactory. There is a professional relationship between physician and patient, too complex for discussion here, that includes submission by the patient to intensive examination and a thorough, objective pursuit by the physician of all the necessary facts about the patient's illness. It seems logical to start the students' experience with living anatomy in a situation that resembles this professional relationship that he needs to develop for an effective career.

Patients, however, are not ideal for this correlation in anatomy. The ill patient is misused as a subject for an inspection and examination that is unrelated to his reasons for hospitalization or clinic visit. Such examination by freshmen students to be effective for learning would be fatiguing and uncomfortable for the patients. A paid model would expect exposure and repeated handling by the students. More importantly, the student does not fear demonstrating his professional immaturity and is not afraid of discomforting someone who is not sick. Such contact allows the students to gain assurance for the clinical situation with patients.

In the Department of Neurology, models have been used in teaching students how to examine the

nervous system and as 'programmed' patients in the clinical examination of medical students in neurology (Barrow sand Abrahamson, 1964). It was felt that these models could provide a source of living anatomy for the freshman students.

Procedure

The freshman anatomy class is made up of about 68 students, assigned four to a cadaver. Ideally, each group about the cadaver should have a living subject immediately available for study at all times during their laboratory dissection. Since this ideal appeared unattainable, more practical ways were sought to make the living body repeatedly available for study by individual students in a manner that would encourage correlation with their cadaver dissection.

It was decided to present a separate 'laboratory in living anatomy' towards the end of each major division of cadaver dissection by the students. The example discussed here is the 'living anatomy laboratory' held at the end of the students' dissection and study of the thorax. This laboratory was scheduled to run concurrently with the usual one-hour lecture and three-hour gross anatomy laboratory time. The students attended this laboratory in groups of 23 students each for 80 minutes, the groups rotating during the morning. In the living anatomy laboratory, five models wearing patient gowns were placed respectively on five examining tables with pads and sheets. There were two men and three women of varying age, race, and body habitus. Each model had his chest radiographs available for study by the students. Students were assigned to one of the five tables, in groups of about five students to each model. A faculty instructor was assigned to each one of the tables. The session began with a demonstration by the instructors of (1) differences in posture, physique, respiratory pattern, and habitus in the male and female thorax, (2) breast anatomy with observation and palpation on both the male and female, (3) significant bony structures and landmarks on the thorax, (4) the action of the diaphragm and intercostal muscles, (5) demonstration of the apical impulse, and (6) important muscle masses, their palpation and function. The students were then encouraged to inspect and examine in the same manner, under the guidance of the faculty member at each table.

The instructors' function was not only to answer questions and repeat demonstrations, but to be sure that each student actually conducted an examination. Near the end of each session, the landmarks for pulmonary, pleural, cardial, and diaphragmatic structures were drawn on the skin of one of the models. This activity reinforced the students' awareness of the structures under the skin in relationship to external body landmarks.

Using this same procedure, similar laboratory sessions in the anatomy of the abdomen and the extremities were also carried out.

Reactions of Students

During the first year that this technique was used, students were interviewed in groups of 15 to 20 after the laboratory demonstration by an interviewer not directly involved in the demonstrations. Their reaction was almost universally favourable. Only one expressed any reservation about this procedure as a valuable learning experience. In the second group interview, deliberate attempts to elicit negative comments were made. They were met by such statements as, 'I can't imagine what any objection would be'. Students demonstrated common agreement that one of the most important results of this exercise was in 'bridging the gap' between cadaver anatomy and the anatomy of the living human being. This relationship between what was observed in the cadaver and what was observed in the living human was expressed as a major gain in learning. As one student put it, 'Even if you can't see it, you have to know it,' referring to structures easily seen in the cadaver but hidden in the living human body.

Gain in Confidence

A second and equally important gain described by the students was the confidence they gained in approaching, inspecting, and palpating a live, naked human being. As one student put it, 'The first time I approached the patient my hands were like ice.' (Interestingly, the students refer to the models as patients.) He then went on, 'I know when I have to approach a real patient I will do it with confidence'. The students also expressed a feeling of growing confidence in simply approaching and speaking to persons who were in the role of patient. Students remarked on their fear of hurting the patient with palpation and their feelings of self-conciousness about their own behaviour all of which were diminished by their experience in the laboratory.

Results of Questionnaire

The second year after this technique was used, a questionnaire was distributed to 69 members of the freshman class after the last of the sessions in which models were used. The first four questions attempted to find out what students felt about using the living human body in this laboratory setting, and the results were as follows:

1. What did you think of this as a teaching technique?

32	27	9	1	0
very good	good	fair	poor	very poor

2. How did it compare with using cadavers as a means of demonstrating gross anatomical characteristics?

24	26	7	10	0
much better	better	same	worse	much worse

3. Did the use of live models help you to understand gross anatomical characteristics?

61 (YES) 6 (NO)

4. How does it compare with using cadavers in helping you to understand gross anatomical characteristics?

19	22	11	12	0
much better	better	same	worse	much worse

Obviously, the students liked this teaching technique. It is interesting to note that many of them considered the use of living people as a more valuable means of 'demonstrating gross anatomical characteristics' than the cadavers. Perhaps the most important item in this cluster was the third question: most of the students felt that they received aid in understanding gross anatomical characteristics.

The investigators tried to ascertain whether the correct balance of time had been achieved. Questions 5 and 6 present this data.

5. Is there value in having more sessions in which live models are presented?

29 (YES) 38 (NO)

6. Would you learn gross anatomy better if there were more opportunity to use live models in conjunction with cadavers?

33 (YES) 33 (NO)

There appears to be an even distribution of responses to questions concerned with whether there should be *more* sessions in which live models are utilized.

Finally, students were asked whether they had any objection to the use of live models in a demonstration of gross anatomical characteristics. Sixty-six responded negatively; there were three, however, who expressed objection to the use of live models.

Effect on Learning

Up to this time, no data had been collected about the possible impact on students' learning of this innovation. Unless a carefully planned experiment can be designed – and carried out – the effect on learning cannot be ascertained. We are considering conducting such an experiment in the near future.

Faculty Reactions

The faculty that participated in this experiment included several disciplines: anatomy, education, internal medicine, neurology, and physiology. The reactions of all were uniformly positive despite the varied backgrounds of training and experience. The following represents a summary of faculty response.

1. The living body offered useful illustrations of basic anatomy subject matter.
2. These illustrations contributed significantly to the students' better understanding of anatomy.
3. The correlation between dissection of the cadaver and observation and palpation of the living human probably contributed to better retention of the material by the students.
4. The early experience with the live, naked human being will significantly aid the students in their first approach to real patients.
5. Being able to approach the living human body for the first time while under faculty supervision also served to build up the students' confidence.

Conclusions

When we considered both student response and faculty reaction, we concluded that the laboratory achieved the goals outlined above and provided an excellent early introduction to the patient and the naked human body and further reinforced the students' education in anatomy by offering immediate correlation with the living human being.

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APPENDIX 6

THE USE OF SIMULATED PATIENTS IN MEDICAL TEACHING +

BY

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And: Cooperative Research Project - Office of Education
OE 6-10-121

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INTRODUCTION:

Mock warfare, mock trials and aircraft trainers are but a few examples of simulation used to teach, evaluate and provide practical experience for the student before he is ready to assume full responsibility. Simulated teaching is controlled; the student's experience is free of unexpected or unknown variables; and his responses or actions can be recorded and evaluated relative to performances by other students and the goals of the teacher. Over the past three years we have developed patient simulation in many areas of medical education to teach and evaluate clinical performance by the student. To teach patient care is the stated goal of our medical school and certainly a goal implied in the M.D. degree. Despite this, it is amazing how little armamentarium there is in medical education to accurately appraise the performance of a physician-to-be at the bedside and to teach clinical medicine in a simulated or controlled situation that provides experience dictated by the teacher.

For patient simulation we utilize people who have been specially trained and oriented to perform as patients. In many instances this requires their giving a history and simulating the clinical findings of a patient with a particular disease entity.

Advantages Of The Simulated Patient

The simulated patient has the following advantages over the use of real patients in the teaching situation:

(1) The student can practice examination technique on simulated patients without the embarrassment a neophyte feels in front of ill patients and without concern for tiring them, hurting them, or aggravating their illness.

(2) The simulated patient can be examined over and over until the student's technique is sure and satisfactory to the instructor and himself.

(3) All necessary aspects of disease complications and prognosis can be freely discussed in front of the simulated patient without concern for their reaction to such information.

(4) Real patients that are used for clinical teaching are relieved of being subjects for teaching skills unrelated to their illness, its care and evaluation.

(5) A clinical problem can be presented to a student in which all the findings can be predetermined, allowing for careful evaluation of the student's clinical ability.

(6) The same clinical problem can be presented again and again to different students allowing for inter-student comparison and for evaluation of the effectiveness of the teaching program.

(7) A trained simulated patient can report objectively on the student physician's skills, physician-patient rapport, manner, approach, etc.

The objection raised against the simulated patient can be stated as follows: "A fake patient is no substitute for a real patient. All clinical teaching should be based on real patients." This objection ignores the fact that the simulated patient provides an intermediate between texts, lectures, protocols, slides and movie films which in no way resemble reality or a real patient. This intermediate is a real, living, reacting human on which the student can sharpen and perfect his clinical skills and be evaluated for his ability to perform in the clinical arena.

Training Of The Simulated Patients

The details of the training of simulated patients cannot be described here. It has been described, in part, previously. Basically the training program consists of any or all of the following steps depending on the specific use of the simulated patient:

(1) Orientation to the clinical setting and the simulated patient technique (films and demonstrations are utilized in this phase).

(2) Employment as subjects in class demonstrations of anatomy, examination techniques, etc.

(3) Observation by simulated patients of patients being interviewed and examined, especially patients showing phenomena to be presented by the simulated patient.

(4) Teaching the simulated patient to incorporate a patient's clinical problem as their own. They are taught the patient's experience with the disease process and how to simulate the patient's findings.

(5) Coaching the simulated patient to behave in the interview and examination as a patient (for this phase we now use an experienced patient simulator who is a professional actress).

(6) Independent evaluation and critique of a trained simulated patient's performance by a member of the teaching faculty who has had no contact with the training program.

Present Uses Of The Simulated Patient

A. Laboratory In Living Anatomy

The goals of freshmen anatomy are to teach living anatomy. It is important to have the student apply the information he obtains from the cadaver to the living human body. At the end of each major section in gross anatomy; i.e., the thorax, abdomen, extremities, etc., the students spend time in a clinic-laboratory where the simulated patient can be examined by the students, under faculty supervision, for bony landmarks, musculature, tendinous insertions, palpable organs, vessels and glands. They can perform skin mapping of underlying viscera and observe functional phenomenal related to anatomical structure; i.e., joint motion, muscle action, respiratory and cardiovascular movements. In this manner the students correlate cadaver information to a living subject, the patient. In this contact with disrobed simulated patients, the student can overcome any embarrassment and concern in such an encounter early in his career so that objective attitudes can be developed allowing the student to learn more effectively from subsequent patient encounters. This clinic-laboratory has gained

enthusiastic acceptance by all students and faculty involved.

B. Teaching Clinical Neurology In Remote Areas

The Neurology Department was able to present a series of ten workshops in neurology as part of a postgraduate course offered to physicians in a resort hotel in Hawaii where real patients would be impossible to find. In all these workshops, that covered the gamut of important neurological conditions, one simulated patient was used. She simulated thirteen different neurological patient problems. Her simulations were based on actual cases, selected for their teaching value from the departmental files. Despite the holiday atmosphere, her presence in bed in a patient gown brought the physicians minds to bear on clinical medicine more effectively than could slides, films or protocols. As on bedside rounds, her case history was recited by a faculty member and then a member of the student group was asked to come and examine the patient for the group. His approach was observed and commented on by the student group and faculty producing group participation in a truly workshop situation. The simulated patient effectively produced coma, seizures, paralysis, sensory losses, reflex changes, blindnesses, etc., as required in patients she was simulating. Physician after physician in this workshop commented on the realism of her performance and how easily they forgot that she was not a real patient. Phenomena that cannot be simulated as papilledema, atrophy, fasciculation, etc., are described and the examining physician is asked to assume their presence. However, this was rarely necessary. The actual EEG, X-rays, EMG, lab data of the patients simulated were given to the group as requested. In

this manner a broad clinical workshop can be offered to any group in any remote area with only one simulated patient and one instructor. Even areas where patients are available such a variety of illustrative problems could not be found.

C. Evaluation Of Clinical Neurological Performance

On the clinical clerkship in neurology our goals are to teach these third year medical students to perform a neurological examination, synthesize their findings into a logical concept of altered neuroanatomy or neurophysiology, arrive at a logical etiological impression and differential diagnosis, and plan an effective workup utilizing laboratory and diagnostic procedures. Quizzes, oral or written, do not test these goals. Reporting the results of a real patient examination does not allow for evaluation of the students technique or for comparison between students since they can't all examine the same patient. This type of test is fraught with variables in terms of the responses of a particular patient at any given time. The simulated patient can present a repeatable history, in the manner of a real patient, and repeatable neurological findings based on those of an actual patient. In addition, this simulated patient, especially trained, can subsequently report on the details of the students examination technique and bedside manner. This technique, over the past three years, has proven to be an effective method for evaluating clinical performance and has provided the individual student with valuable feedback concerning errors in his technique, manner and neurological thinking that could not have been found otherwise. Again, many students described

how easily they forgot this was not a real patient they were examining as testimony to the realism of this procedure.

D. Workshop In The Neurological Examination

Here the simulated patient is used as a subject for demonstration and practice of techniques in the neurological examination in a small workshop consisting of a faculty member and a few students. After demonstrations by the faculty member the student can work out his examination technique before he has to face the real patient. The consequences of neurological disease and significance of neurological findings can be freely discussed by the faculty and the simulated patient can be examined and reexamined without concern for his welfare or reaction since he is being hired to be a subject.

E. Demonstration Of Basic Neurological And Neurosurgical Principles

As an extension of the workshop technique the simulated patient is used in larger medical school classes to demonstrate principles and techniques used in evaluating patients in coma, with seizures, aphasia, back pain, etc.

F. Other Uses

Based on the advantages of simulated patient over real patients in teaching, there have been many other ways in which their services have been used. The psychiatry department utilized a simulated patient to prepare teaching tapes on the psychiatric interview. They have been used in the preparation of several films and educational television shows by many

different departments. In one television show the simulation was so convicing that many clinicians in the audience felt they were watching a real patient (with an aphasia and hemiparesis) despite a final credit mentioning the patient simulation. Here a patient was spared agonizing hours under hot lights with rehearsals and repeats; yet the audience had the illusion that they were actively involved in an acute medical problem. The simulated patient has been utilized recently as an evaluation technique for a clinical teaching innovation by offering the same test to paired experimental and control groups of students.

SUMMARY:

This paper has described the use of simulated patients as a controlled technique to teach and evaluate clinical performance in medical education. The advantages of this technique and its varied uses, particularly in neurology, were described.

The increasing use of simulated patients in this medical school over the past three years and its adoption by other schools indicates its usefulness.

REFERENCES

1. HOWARD S. BARROWS, M.D., PAUL R. PATEK, Ph.D., AND STEPHEN ABRAHAMSON, Ph.D. "The Introduction Of The Living Human Body In Freshman Gross Anatomy"; Brit. J. of Med. Ed.; (Accepted For Publication) January, 1967

2. HOWARD S. BARROWS, M.D. AND STEPHEN ABRAHAMSON, Ph.D. "The Programmed Patient: A Technique For Appraising Student Performance In Clinical Neurology"; J. of Med. Ed., Vol. 39, No. 8, pp. 802-805, August, 1964.

APPENDIX 7

Use of the "Programmed Patient" in Neurosurgery Teaching

1. As a pre-test for fourth year students at the outset of the Clerkship.

2. In the third year lecture series.

3. In an experimental study of Residency training on the Ward service.

4. As a filmed demonstration of the technique for international dissemination.

APPENDIX 8

Other uses to which the "Programmed Patient" has been made available.

1. The Los Angeles County/USC Medical Center Research and Training Center courses.

2. Testing UCLA Psychiatry Residents' skill in the Neurological Examination.

3. Teaching USC Psychiatrists the Neurological Examination in preparation for their Board Examinations.

4. Wide use in Postgraduate courses throughout the U.S., Canada, Europe, etc.

5. To evaluate PT Intern performance at Rancho Los Amigos Hospital in Los Angeles.

6. Wide use in Educational and CCTV (USC, UCLA, Loma Linda, etc.).

7. In the development of a teaching machine in Psychiatry at MSU.

APPENDIX 9

SIMULATIONS NOW IN USE:

1. Aphasia (Acute Hemisphere Lesion)
2. Polymiositis (Myopathy, Dystrophy, Myositis & Myotonia)
3. Posterior Fossa (Progressive Cerebral Degeneration)
4. Headache (Sub. Hemorrhage)
5. Paroxysmal Disorder - Case A: 18 year old boy
6. Paroxysmal Disorder - Case B: Seizure
7. Polyneuritis - Case A: 26 year old female
8. Polyneuritis - Case B: 34 year old female
9. Multiple Sclerosis (Acute Spinal Cord Disease)
10. Headache (Tumor of the third ventricle - Colloid Cyst)
11. Brain Tumor
12. Intramedullary Astrocytoma of Cervical Cord
13. Motor Neuron Diseases & their Imitators
14. Cerebral Contusion
15. Cerebral Infarction
16. Non-dominant Hemisphere Parietal Lobe Syndrome

APPENDIX 10

CARTRIDGES COMPLETED TO DATE:	NUMBER:
Exam of Reflexes. Parts 1A - 1B - 2 - 3	4
Exam of Motor System. Parts 1A - 1B - 1C - 2A - 2B - 2C	6
Sensory Exam. Parts 1 - 2 - 3	3
Cranial Nerve Exam. Parts 1 - 2 - 3 - 4 - 5	5
Meningeal Nerve & Vascular Exam. Parts 1	1
Lumbar Puncture. Parts 1 - 2	2
Spinal Manometrics. Parts 1	1
Midline Echo U.E.G. Parts - 1 - Normal & 2 - Shifted	2
Stryker Frame. Parts 1 - 2	2
Lower Motor Neuron Disease. Parts 1 - 2 - 3A - 3B - 4	5
Cerebellar Disease. Parts 1 - 2 - 3	3
COMPLETED AND AVAILABLE TO DATE:	34

APPENDIX 11

CARTRIDGES IN PRODUCTION:	NUMBER:
"SKELATOMUSCULAR EXAM"	15
Parts 1 - 15. Shot, Cut & Titled. Ready for final edit, A & B cut & printing.	
"DYSTONIA"	8 ?
Filming of General Subjects completed. Ready for Timing and W/P cutting.	
"MYASTHENIA GRAVIS"	7 ?
Patients filmed - ready for Story Board, Title shooting and W/P cutting.	
"COMA"	6 ?
Filming of subject completed. Ready for title shooting and W/P cutting.	
	36 approx

(Location shooting of Medical Convention, Hawaii - 1200')

APPENDIX 12

The Student Study and Library

This contract, in conjunction with the Union Oil Company, the Los Angeles County General Hospital, the USC School of Medicine and the Neurology Training Grant has provided an Undergraduate and Graduate study facility and library on the Clinical Neurology Ward of the Medical Center containing: a conference table, seven chairs, two bookcases, an air conditioner, two projectors and two sets of cartridges, two sets of "Archives of Neurology" and "Neurology," 150 books and five journals.